(University of Choice)

MASINDEMULIROUNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

(MAIN CAMPUS)

MAIN EXAMINATIONS

2021/2022 ACADEMIC YEAR

FIFTH YEAR FIRST SEMESTER

BACHELOR OF SCIENCE (CIVIL AND STRUCTURAL ENGINEERING, MECHANICAL AND INDUSTRIAL ENGINEERING AND ELECTRICAL AND COMMUNICATION ENGINEERING)

COURSE CODE   :   **ECC 501**

COURSE TITLE   :   OPERATION RESEARCH

DATE: 26th April, 2022   TIME: 03:00p.m-05:00p.m

INSTRUCTIONS TO CANDIDATES

Attempt question **ONE (1)** and **ANY TWO (2)** other questions
Read additional instructions under various sections

MMUST observes ZERO tolerance to examination cheating

QUESTION ONE (30 MARKS)

a) Define the following terms as used in operations research   (3 Marks)
     i)   Operations Research
     ii)   Optimization
     iii)   Linear Programing

b) State any three limitations of linear programing.   (3 Marks)

c) Highlight the first four steps in solving transportation problems using stepping stone method.   (4 Marks)

d) Solve graphically the minimization problem below and its dual maximization.   (6 Marks)
      (6 Marks)

Minimize $z = 12x_1 + 16x_2$

Subject to $\begin{array}{l} x_1 + 2x_2 \geq 40 \\ x_1 + x_2 \geq 30 \end{array}$

$$x_1 \geq 0, x_2 \geq 0$$

e) Describe three steps involved in Vogel's Approximation method as used in Operations Research.   (3 Marks)

f) State the two main conditions for applying Hungarian Method in linear programing   (2 Marks)

g) Give any three areas where assignment method is applicable operations research.   (3 Marks)

QUESTION TWO (20 MARKS)

a) Obtain an initial basic feasible solution to the following transportation problem using list cost method.   (10 Marks)

Source	Destination				Supply
	1	2	3	4	
1	11	13	17	14	250
2	16	18	14	10	300
3	21	24	13	10	400
Demand	200	225	275	250	950

b) Assign the four tasks to four operators. The assigning costs are in table below.

(10 Marks)

	Operators		
1	2	3	4
20	28	19	13
15	30	31	28
40	21	20	17
21	28	26	12

QUESTION THREE (20 MARKS)

a) Solve the following linear programing problem using simplex method.

Minimize $2x_1 - 3x_2 + 6x_3$ (6 Marks)

$$3x_1 - x_2 + 2x_3 \leq 7$$

Subject to $2x_1 + 4x_2 \geq -12$

$$-4x_1 + 3x_2 + 8x_3 \leq 10$$

$$x_1, x_2 \text{ and } x_3 \geq 0$$

b) State three processes involved in the formulation of linear programing problems as used in the operations research. (3 Marks)

c) Consider 3 jobs to be assigned to 3 machines, the cost of each combination is shown in the table below. Determine the minimal job-machine combinations. (4 Marks)

Job	Machine			
	1	2	3	ai
1	5	7	9	1
2	14	10	12	1
3	15	13	16	1
bj	1	1	1	

d) Sterling Milk Company has three plants located throughout a state with production capacity of 40, 60 and 50 gallons. Each day the firm must furnish its four retail shops A, B, C and D with at least 20, 30, 50 and 50 gallons respectively. Find the optimal cost given the information in table 1 below. (7 Marks)

	A	B	C	D	Supply
I	4	6	8	8	40
II	6	8	6	7	60
III	5	7	6	8	50
Demand	20	30	50	50	150

QUESTION FOUR (20 MARKS)

a) Luminous lamps produces three types of lamps; A, B and C. These lamps are processed on the three machines; X, Y and Z. The full technology and input restrictions are given in the following table.

Product	Machines			Profit per Unit
	X	Y	Z	
A	10	7	2	12
B	2	3	4	3
C	1	2	1	1
Available Time	100	77	80	

Find out a suitable product mix so as to maximize the profit.   (7 Marks)

b) Compute the transportation cost from the table below using North Ways Methods.

(6 Marks)

	Destination				Available
	A	B	C	D	
I	21	16	25	8	150
II	17	18	14	11	100
III	33	27	6	3	250
Requirements	40	10	150	300	500

c) Differentiate between the following terms.   (2 Marks)
   (i)   Dijkestra algorithm and Sensitivity Analysis
   (ii)   Linearity and Constrain

d) Maximize $x - 5y + 4w$ subject to the constraints   (5 Marks)
   $x + y + w \leq 6$
   $x + 2y + 3w \leq 8$
   $x + 3y + 9w \leq 12$
   With $x, y, w \geq 0$